

Guest Editor: Bhim S. Pandhi

Common Pediatric Medical Emergencies in Office Practice

Bharat Mehra¹  · Suresh Gupta¹

Received: 16 February 2017 / Accepted: 27 April 2017 / Published online: 12 August 2017
© Dr. K C Chaudhuri Foundation 2017

Abstract General Practitioners frequently see children with medical conditions that may evolve into an emergency if not promptly attended to. The most common emergencies encountered in pediatric office practice are respiratory distress, dehydration, anaphylaxis, seizures and trauma. Assessment of children is sometimes difficult as the signs and symptoms might be subtle and not markedly expressed. Also, normal value of vital signs vary with age, thus their interpretation requires discrete knowledge of age appropriate values. Initial approach to a sick child involves formation of initial impression, doing primary assessment, proper history taking and classifying the condition into following categories: Respiratory distress, Respiratory failure, Compensated shock, Decompensated shock and Primary brain dysfunction. Initial management of any pediatric emergency involves assessment of airway, breathing and circulation and providing relevant adequate support. Majority of cardiac arrests in pediatric practice are secondary to progressive respiratory failure and thus, if intervened timely and effectively, will prevent fatal outcome. In a child with shock, compensated state can rapidly evolve to decompensated state, thus necessitating its early recognition and rapid intervention. Anaphylaxis should be suspected in any child with sudden onset of skin or mucosal symptoms along with respiratory, circulatory or gastro-intestinal involvement and adrenaline should be given by intra-muscular route.

Keywords Pediatric emergency · Respiratory distress · Gastroenteritis · Shock · Trauma · Seizure · Anaphylaxis

Introduction

General practitioners frequently see children in their office with medical conditions that may evolve into an emergency if not promptly attended to. Acute and life-threatening conditions are not uncommon in general practice, but when they do occur, they require prompt and meticulous care as faulty treatment or delays in management, can mean the difference between survival and death.

The most common emergencies encountered in pediatric office practice are respiratory distress, dehydration (and shock), anaphylaxis, seizures and trauma.

Identifying a Sick Child

Assessment of children is sometimes difficult as the signs and symptoms of illness may not be as marked or as readily expressed as those in adults. Also, normal value of vital signs vary with age, thus their interpretation requires discrete knowledge of age appropriate values.

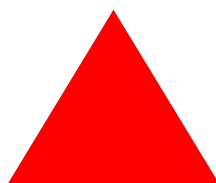
Initial Impression [1]

It is the first quick assessment of the child by just looking and listening (without even touching) which can be done within seconds of encountering the child. It consists of assessing consciousness, breathing and color (Fig. 1).

✉ Bharat Mehra
bharatmehra909@gmail.com

¹ Division of Pediatric Emergency and Critical Care, Department of Pediatrics, Institute of Child Health, Sir Ganga Ram Hospital, Rajinder Nagar, New Delhi 110060, India

Level of Consciousness
(e.g., Alert, irritable,
unresponsive)



Color
(Abnormal color e.g., Pale, mottled, flushed, cyanosis)

Breathing
(Increased work of breathing, abnormal sounds heard
without auscultation e.g., Stridor, grunting)

Fig. 1 Pediatric assessment triangle

Primary Assessment [1]

On examination, assess ABCDE (Fig. 2):

A - Airway: Clear/ Maintainable/ Not Maintainable – Look for presence of inspiratory sounds *viz.*, bubbly sounds, snoring, stridor, grunting and wheeze are suggestive of partial or complete obstruction of the airway.

B - Breathing: Presence of tachypnea, bradypnea, chest retractions, nasal flaring, increased effort while breathing, head bobbing, abnormal chest sounds, asymmetrical air entry, cyanosis are suggestive of respiratory distress.

C - Circulation: Presence of tachycardia, bradycardia, weak/absent peripheral pulses, prolonged capillary refill time, hypotension, mottling, cold extremities, deteriorating consciousness, acidotic breathing are suggestive of inadequate peripheral circulation (shock).

D - Disability: AVPU scale (Alert, Responsive to Voice, Responsive to Pain, Unresponsive), Glasgow coma scale (GCS), Pupillary response to light.

E - Exposure: Temperature, skin rash, petechiae, purpura, injury.

History Taking

Ask for: High grade fever, rash, persistent vomiting, noisy breathing, labored breathing, poor feeding, lethargy,

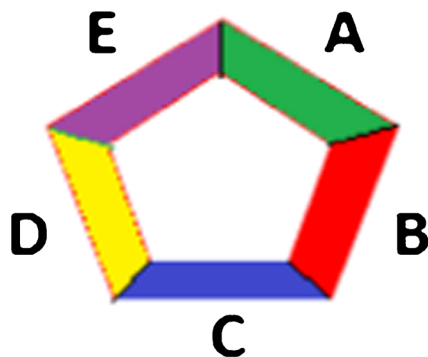


Fig. 2 Primary assessment

decreased urine output, acute onset of pallor, abdominal distension, any allergies, medications and past history of any significant illness.

A decreased level of consciousness, confusion and agitation may each be an indication of inadequate circulation to the brain- suggestive of either hypoxia (impending respiratory failure), shock or primary brain dysfunction.

After initial impression and primary assessment, one is able to rule out any life-threatening problems and broadly classifies the sick child into following categories: respiratory distress, respiratory failure, compensated shock, decompensated shock and primary brain dysfunction.

Approach to a Child with Respiratory Distress

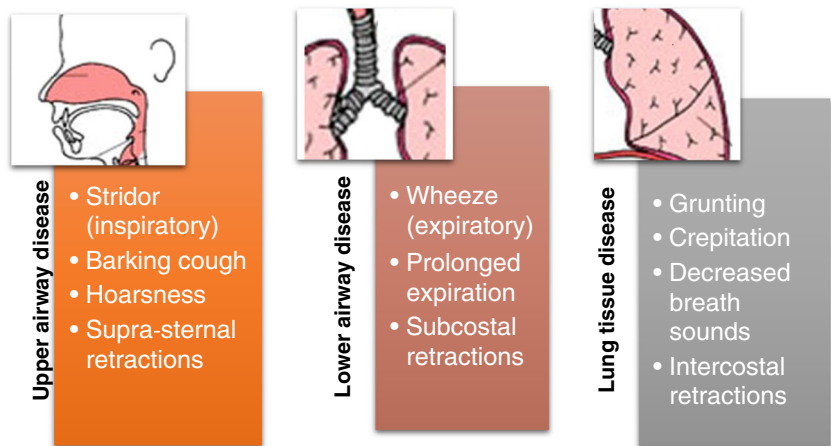
When a child presents with difficulty in breathing, it is essential to establish the site of the disease *i.e.* whether it involves upper airways (oropharynx, nasopharynx, larynx), lower airways (trachea, bronchi, bronchioles), lung parenchyma, central control of breathing or a combination of these (Table 1). When respiratory effort is inadequate to sustain the effective gas exchange (oxygenation and removal of CO₂), respiratory failure ensues. Respiratory failure is the end stage of respiratory distress, and it requires urgent intervention to prevent deterioration to cardiac arrest. It is important to realize here that majority of cardiac arrests in pediatric practice are

Table 1 Common causes of respiratory distress seen in office practice

Upper airway disease	Lower airway disease	Lung parenchyma disease
Angioneurotic edema	Bronchiolitis	Pneumonia
Enlarged tonsils, adenoids	Asthma	ARDS
Inflamed sinuses	Foreign Body	Pulmonary edema
Croup	Para-tracheal lymph node enlargement	Pleural effusion
Epiglottitis		Pneumothorax

ARDS Acute respiratory distress syndrome

Fig. 3 Signs of respiratory distress according to the site of disease



secondary to progressive respiratory failure, and thus if intervened timely and effectively, will prevent the fatal outcome.

Clinical signs of respiratory distress include (Fig. 3):

- *Abnormal respiratory rate or effort*– Tachypnea, bradypnea or hypoventilation, nasal flaring, chest retractions and use of accessory muscles
- *Abnormal airway sounds*– Stridor, wheezing, grunting
- *Deterioration in skin color*– Pale, cool skin, cyanosis
- *Changes in level of consciousness*– Drowsy, markedly irritable or agitated

General Management

- Keep the child in the position of comfort and minimize agitation.
- If upper airway obstruction is suspected, then perform manual airway measures such as head tilt -chin lift, jaw thrust (in case of suspected cervical spine injury).
- Suctioning of nose or mouth if secretions are present.
- Provide humidified oxygen, preferably with high concentration delivery device *e.g.*, Head box (for infants less than 6 mo), Oxymask or non-rebreathing mask (for older children).

- Start inhaled medications as indicated.
- Monitor heart rate, respiratory rate, blood pressure and SpO₂.
- Establish vascular access (for fluid therapy and medications as indicated).

Specific Management

After initial stabilization of the child with respiratory distress, further management depends upon the underlying etiology (Tables 2, 3 and 4).

Respiratory Distress: Pediatric Emergency Pearls

- Rapid breathing may be due to the following which should be clinically identified:
 - Cardiac failure
 - Metabolic acidosis
 - Neurological diseases
- Don't use bronchodilators in infants < 6 mo of age.

Table 2 Specific management of croup [2]

Severity of croup	Features	Management
Mild	Barking cough, but no stridor at rest, mild retractions may be present	Reassure parents, explain warning signs, no specific treatment
Moderate	Stridor at rest, chest retractions, use of accessory muscles but is interactive, alert.	Nebulized adrenaline 0.5 ml/kg of 1:1000 solution (max 5 ml) Oral/IV/IM dexamethasone 0.3 mg/kg OR prednisone/ prednisolone 1 mg/kg Observe for atleast 4 h
Severe	Marked respiratory distress, restless, irritable, tachycardia*	Shift to pediatric center with ICU facility

*Oximetry is not a reliable marker of severity in croup

Table 3 Specific management of bronchiolitis [3]

Severity of bronchiolitis	Features	Management
Mild	Little or no respiratory distress, able to feed, SpO ₂ above 95% on room air	Home management with nasal saline drops
Moderate	Features of respiratory distress with SpO ₂ 90–95% on room air, difficulty in feeding but able to take more than 50% of normal feed	Requires admission and monitoring Humidified oxygen, nasogastric feeding, nebulization with hypertonic saline and adrenaline
Severe	Marked respiratory distress, restless, irritable, tachycardia	Shift to pediatric center with ICU facility Requires non-invasive ventilation (NIV) such as humidified high flow nasal cannula, or ventilator support

When to Refer:

- Tachypnea, tachycardia
- Chest indrawing
- Severe cough
- Cyanosis
- Too sick to feed

Approach to a Child with Acute Gastroenteritis and Dehydration

Acute gastroenteritis (AGE) is a diarrheal disease of rapid onset, with or without accompanying symptoms and signs, such as nausea, vomiting, fever, or abdominal pain. It is a common cause of presentation to the emergency department (ED) in children under 5 y of age. It continues to be a major cause of morbidity and mortality in developing countries.

Most children have self-limited viral or bacterial diarrhea, however, the dehydration caused by the disease is the focus in

this article. Assess the degree of dehydration using the Table 5 and determine the score. Manage the child using the algorithm provided below (Fig. 4).

Acute Gastroenteritis: Pediatric Emergency Pearls

- Use probiotics and oral zinc (10 mg for < 6-mo-old, 20 mg if > 6-mo-old)
- Use WHO recommended low osmolarity ORS
- No routine use of antibiotics
- No anti-secretory agents (*e.g.*, Raccadrotil, loperamide)

When to Refer:

- Persistent/ chronic diarrhea
- Persistent watery stools
- Malnourished child
- No clinical improvement after 3 h of ORT/IV fluids
- Persistent vomiting, lethargy, dyselektroemia

Table 4 Specific management of asthma [4]

Severity of asthma	Features	Management
Mild	Little or no respiratory distress, SpO ₂ above 95% on room air. Alert and oriented.	No supplemental oxygen needed. Manage with salbutamol and inhaled steroids by Metered Dose Inhaler (MDI) and spacer
Moderate	Features of respiratory distress with SpO ₂ 90–94% on room air, mild tachycardia. Able to talk in phrases (if normally able) or have a shortened cry. Alert and oriented.	Requires admission and monitoring - Humidified oxygen, manage with salbutamol and ipratropium, MDI and spacer - Salbutamol 100 µg. Give 6 puffs (children under 6 y) or 12 puffs (children 6 y and over) - Consider ipratropium 20 µg 4 puffs (children under 6 y) or 8 puffs (children 6 y and over) every 20 min together with salbutamol - Oral prednisone (1–2 mg/kg/d)
Severe	Marked respiratory distress, tachycardia, SpO ₂ < 90% on room air. Able to talk in words (if normally able) with weak cry or unable to speak or cry. Confused, restless, irritable.	Shift to pediatric center with ICU facility Nebulize with salbutamol, ipratropium, IV steroids Requires non-invasive ventilation (NIV) such as continuous positive airway pressure (CPAP), or ventilator support

Table 5 Clinical dehydration scale [5]

Clinical features/Score	0	1	2
General appearance	Normal	Thirsty, restless, or lethargic but irritable when touched	Drowsy, limp, cold, sweaty
Eyes	Normal	Slightly sunken	Very sunken
Mucous membranes	Moist	Sticky	Dry
Tears	Present	Decreased	Absent

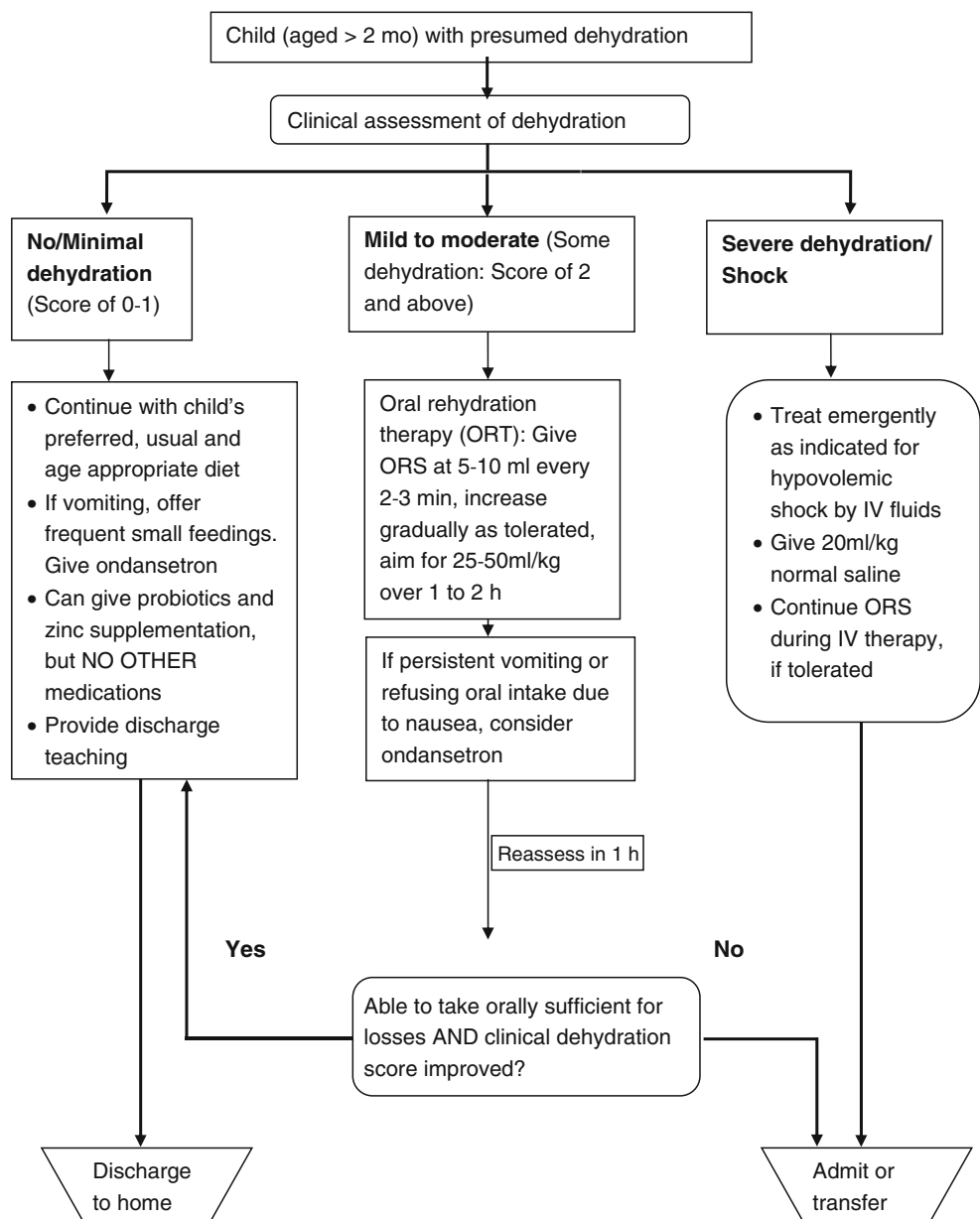
Approach to a Child with Shock

Shock is a critical condition which is characterized by inadequate tissue delivery of oxygen and nutrients to meet the tissue metabolic demands. Broadly, shock can be classified into hypovolemic (e.g., dehydration from

gastroenteritis), distributive (e.g., septic shock, anaphylactic shock), cardiogenic shock (e.g., myocarditis), obstructive shock (e.g., cardiac tamponade, tension pneumothorax).

Early recognition and rapid intervention are critical to halt the progression from a compensated state to decompensated

Fig. 4 Algorithm for management of a child with acute gastroenteritis



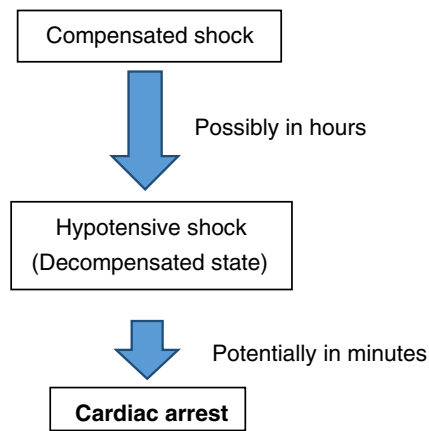


Fig. 5 Evolution of shock

(hypotensive) state to cardio-respiratory failure and cardiac arrest (Fig. 5) [6].

Suspect a child in shock if:

1. Presence of tachycardia
2. *Quiet* tachypnea (fast breathing without increased effort)
3. Cold, pale, mottled, diaphoretic skin
4. Delayed capillary refill (> 3 s)
5. Weak peripheral pulses, narrow pulse pressure
6. History of decreased urine output
7. Changes in level of consciousness (irritable, lethargy, drowsy)

Note: In septic shock (warm type), usually there is warm flushed skin with brisk capillary refill, bounding character of peripheral pulses with wide pulse pressure.

Fundamentals of Initial Shock Management

1. *Position the child:* If the child seems stable then allow the child to remain in the most comfortable position. However, if the child is unstable then make him lie supine, with head 30° below the feet.
2. Start *high flow oxygen* (e.g., head box in infants, or non re-breathing mask in older)
3. Support *ventilation:* Use of continuous positive airway pressure (CPAP) or invasive mechanical ventilation with positive end expiratory pressure (PEEP).
4. Establish *vascular access* for *fluid resuscitation* and administration of medications. Give rapid fluid bolus of 20 ml/kg over 5 to 10 min in hypovolemic and distributive shock. Reassess after each fluid bolus.
5. However decrease the rate and volume of fluid bolus in cardiogenic shock (5 ml/kg over 10–20 min) and diabetic ketoacidosis (10 ml/kg over 1 h)
6. Use *isotonic crystalloids solutions* such as normal saline (NS) or lactated Ringer lactate (RL) for initial rapid fluid

resuscitation. For trauma and hemorrhage, administer blood (packed RBCs) if child does not respond to isotonic crystalloids.

7. *Monitor* heart rate, SpO₂, blood pressure, level of consciousness, temperature and urine output. Perform *frequent assessment* to determine the response to therapy.
8. Take initial *blood samples* for basic laboratory studies. Identify and correct hypoglycemia and hypocalcemia early.
9. Give *medications e.g.*, vasoactive agents (dopamine, epinephrine), dextrose, calcium, antibiotics, analgesic. Give 1st dose of antibiotic in septic shock preferably within 1st hour of presentation.
10. *Refer* to pediatric facility with intensive care monitoring for further management.

Approach to a Child with Seizure

The management of seizures requires the following approach (Fig. 6).

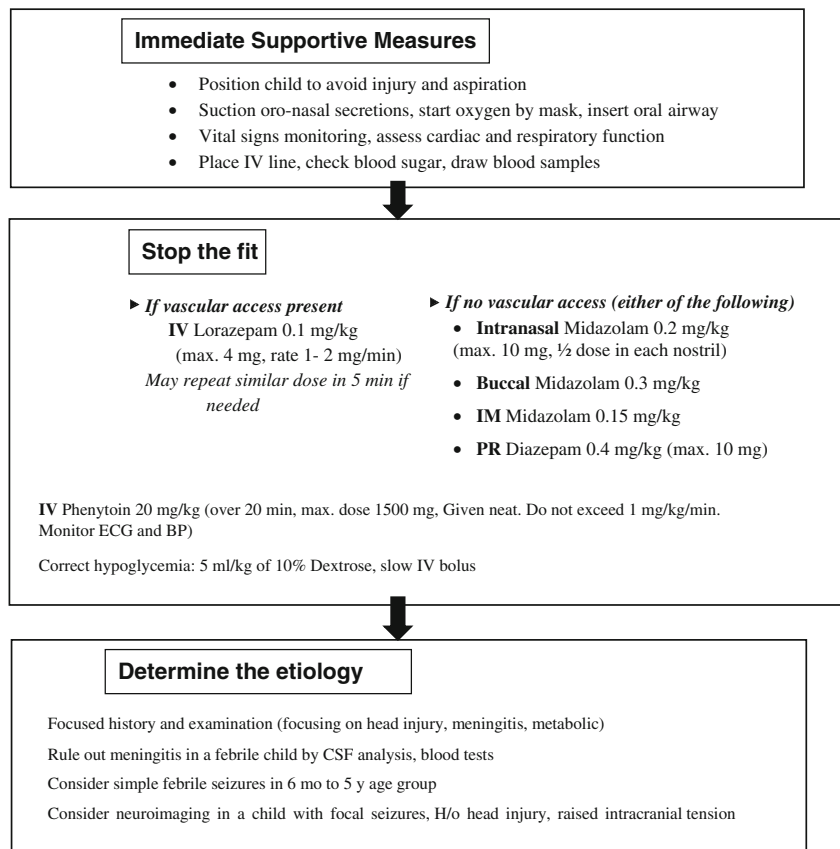
Seizure: Pediatric Emergency Pearls

- In the algorithm, the timing is from onset of seizure, and not from the arrival to the emergency department.
- In status epilepticus management there is no need for prophylactic phenytoin if the seizure has been easily aborted.
- Start IV fluids at normal maintenance, avoid fluid overload (risk of cerebral edema).
- Check blood pressure every 5 min during medication with benzodiazepenes and other anti-epileptics, then every 10 min during postictal period until stable.
- If the volume of phenytoin is too small, dilute in N/Saline (NOT Dextrose solutions) in a minimum sized syringe.
- Prolonged seizures and/or repeated doses of anti-epileptic medications may cause prolonged depression of consciousness and lead to compromise of airway and breathing, requiring ongoing support including intubation.

Approach to a Child with Suspected Anaphylaxis

It is a clinical syndrome of immediate hypersensitivity, characterised by cardiovascular collapse, respiratory compromise, cutaneous and gastrointestinal (GI) symptoms. This life-threatening hypersensitivity reaction can be difficult to recognize sometimes because it can

Fig. 6 Initial management of a child with seizure



mimic other presentations and is very variable in its presentation.

Suspect anaphylaxis when [7]:

Acute onset of an illness (minutes to several hours) involving the skin, mucosal tissue, or both (e.g. generalized hives, pruritus, or flushing, swollen lips, tongue, uvula) and at least one of the following:

1. Respiratory compromise- difficulty in breathing, wheeze, bronchospasm, reduced peak expiratory flow, hypoxemia or
2. Reduced blood pressure or associated symptoms and signs of end organ hypoperfusion e.g. syncope (collapse), hypotonia, incontinence
3. Persistent GI symptoms and signs (e.g. crampy abdominal pain, vomiting, diarrhea)

Management [8]

Assess ABC: Establish airway (A) if necessary, start 100% oxygen with respiratory support (B) as needed, (C): Assess circulation and establish large bore IV access. Place on cardiac monitor.

Position:

- Upright, if mainly respiratory with minimal cardiovascular involvement.

- Supine or Trendelenburg if mainly cardiovascular with minimal respiratory involvement.

GIVE Adrenaline (The wonder drug):

- 0.01 ml/kg (1:1000) IM (maximum dose 0.5 ml).
- Administer at the anterior-lateral thigh for maximal absorption.
- Repeat every 15 min as needed.

Other Drugs

- **Salbutamol**
- MDI: If good saturations or low flow O₂ 1–2 L/min is required.
 - > 6 y: Salbutamol (100mcg) 12 puffs: Ipratropium (20mcg) 8 puffs
 - < 6 y: Salbutamol 6 puffs: Ipratropium 4 puffs
- Nebulisation: If high flow O₂ is required;
 - > 6 y: Salbutamol (1 mg) 1 ml: Ipratropium (500mcg) 1 ml: 2 ml normal saline
 - < 6 y: Salbutamol 0.5 ml: Ipratropium 0.5 ml: 1 ml normal saline

- *Antihistamines (Choice of)*
 - Diphenhydramine: 1–2 mg/kg IM / IV / PO (maximum dose 50 mg)
 - Promethazine: 0.2–0.5 mg/kg IV / PO (maximum dose 10 mg)
- *Corticosteroids (Choice of)*
 - Hydrocortisone 4 mg/kg IV bolus, then 4 mg/kg every 6 hourly
 - Prednisone 2 mg/kg PO once daily
 - Methylprednisolone 2 mg/kg IV bolus, then 2 mg/kg per day IV or IM divided every 6 hourly

“**Admit all patients with anaphylaxis: Will require observation for late-phase symptoms**”.

Approach to a Child with Trauma [9]

The initial assessment and management of an injured child follows the sequence:

Primary Survey & Resuscitation (Table 6)

- To find and relieve immediate life threatening conditions or injuries.
- Follow C-A-B sequence for resuscitation



Secondary Survey

To identify other injuries such as intra-abdominal injuries, long bone fractures.

Table 6 Primary survey and management in a child with trauma

Primary survey	Management
Airway:	
<ul style="list-style-type: none"> - Assess for any obstruction. Airway can be obstructed from anywhere between lips and carina by direct trauma, edema, secretions, blood, stomach contents, or foreign bodies. - Classic sign of upper airway partial obstruction is inspiratory stridor. 	<ul style="list-style-type: none"> - Open Airway; Suction secretions - Start high flow oxygen - If midface fracture/difficult airway OR direct airway injury- Involve ICU team
Breathing:	
<ul style="list-style-type: none"> - Evaluate the child's ability to ventilate and oxygenate. - Critical findings include absence of spontaneous ventilation, absent or asymmetric breath sounds with hyper resonance on percussion suggesting pneumothorax, dullness on percussion suggesting hemothorax, flail chest 	<ul style="list-style-type: none"> - Needle decompression in case of pneumothorax - Requires chest tube placement - If respiratory failure– Start bag and mask ventilation and prepare for rapid sequence intubation
Circulation:	
<ul style="list-style-type: none"> - Check pulse - External hemorrhage - Sign of shock - Pelvic fracture 	<ul style="list-style-type: none"> - Absent circulation: Start chest compressions - Control major exsanguinating hemorrhage by external compression - Secure IV access, fluid resuscitation - Wrap or bind pelvis
Disability:	
<ul style="list-style-type: none"> GCS, pupillary reaction Signs of spinal cord injury Signs of impending herniation 	<ul style="list-style-type: none"> - Rapidly declining GCS or GCS < 8– Intubate, moderate hyperventilation, take urgent neurosurgical consultation
Exposure:	
<ul style="list-style-type: none"> Identify hypothermia 	<ul style="list-style-type: none"> - Remove wet clothing/linen, initiate rewarming, cover with warm blankets, warm IV fluids and blood products using fluid warmers - Can use external rewarming with a convective air blanket if core temperature < 36°C
<ul style="list-style-type: none"> - Repeat vital signs every 5 min; Re-assess response to intervention - Assess pain and provide adequate analgesia - All significantly injured children must be assumed to have a cervical spine injury until proven otherwise. In case of suspected cervical spine injury, completely immobilize spine, apply cervical collar. 	

GCS Glasgow coma scale

Contributions BM: Performed the literature search and drafted the initial manuscript. SG: Involved in conception and design, supervised and critically reviewed the manuscript. Both authors read and approved the final manuscript. SG will act as guarantor for the paper.

Compliance with Ethical Standards

Conflict of Interest None.

Source of Funding None.

References

1. Chameides L, Samson RA, Schexnayder SM, Hazinski MF. Pediatric advanced life support provider manual. Texas: American Heart Association; 2011. p. 12–26.
2. NSW Department of Health. Infants and children: acute management of croup – clinical practice guideline. NSW department of health. 2010. Available at: http://www0.health.nsw.gov.au/policies/pd/2010/pdf/PD2010_053.pdf. Accessed on 05 Jan 2017.
3. NSW Department of Health. Infants and children: acute management of bronchiolitis – clinical practice guideline. NSW department of health. 2012. Available at: http://www0.health.nsw.gov.au/policies/pd/2012/pdf/PD2012_004.pdf. Accessed on 05 Jan 2017.
4. NSW Department of Health. Infants and children: acute management of asthma – clinical practice guideline. NSW department of health. 2010. Available at: http://www0.health.nsw.gov.au/policies/pd/2012/pdf/PD2012_056.pdf. Accessed on 05 Jan 2017.
5. Goldman RD, Friedman JN, Parkin PC. Validation of the clinical dehydration scale for children with acute gastroenteritis. *Pediatrics*. 2008;122:545–9.
6. Chameides L, Samson RA, Schexnayder SM, Hazinski MF. Pediatric advanced life support provider manual. Texas: American Heart Association; 2011. p. 73.
7. Campbell RL, Hagan JB, Manivannan V, et al. Evaluation of national institute of allergy and infectious diseases/food allergy and anaphylaxis network criteria for the diagnosis of anaphylaxis in emergency department patients. *J Allergy Clin Immunol*. 2012;129:748–52.
8. Lieberman P, Nicklas RA, Randolph C, et al. Anaphylaxis—a practice parameter update 2015. *Ann Allergy Asthma Immunol*. 2015;115:341–84.
9. McFadyen JG, Ramaiah R, Bhananker SM. Initial assessment and management of pediatric trauma patients. *Int J Crit Illness Injury Sci*. 2012;2:121–7.